STATE & PRIVATE FORESTRY
FOREST HEALTH PROTECTION
SOUTH SIERRA SHARED SERVICE AREA

Report No. SS11-01

File No. 3420
Dec 19, 2010

To: **Tina Terrell, Sequoia National Forest, Forest Supervisor**
Steve Hanna, Sequoia National Forest, Forest Silviculturist
Rick Larson, Kernville Ranger District, District Ranger
Brenda Ehmann, Kernville Ranger District, Deputy District Ranger

Re: **Insect and Disease Risk on Joey Project, Sequoia National Forest, Kernville Ranger District**

Recommended Strategy

Overall, remaining untreated areas of the Joey Project are in good forest health and it is the recommendation of FHP that the forest should do everything it can to maintain this state. All too often Ranger Districts find themselves faced with forest health problems which provide few truly good options. In this case, Kernville RD has the option of being able to apply optimal forest health strategies to ensure that future land managers inherit a project area in better forest health condition than presently. Twenty to thirty years ago when foresters were faced with stands with few obvious Forest Health problems they chose to take minimal, if any, prevention precautions. It was these decisions that frequently led to current Forest Health problems that have so few good options today. It is our contention that the relatively good forest health condition of the Joey project, the forest should aggressively follow forest health strategies to retain its integrity.

While we recognize that thinning as a Forest Health strategy is not foolproof, and re-entries may be required for some stands. However, at this point in time the Joey Project area is not one of these areas. Thinning treatments that reduce basal area below 120 sq ft / acre is the best prevention measure against bark beetle outbreaks. Thinnings that approach 120 sq ft also reduce fuels loading and catastrophic fire risk. Given the luxury of an area that is currently in good health, treatments that reduce density ensure that foresters, twenty years from now, have stands in optimal health.

In the project area, Heterobasidion root rot is so common that the application of an approved borate treatment will buy us little. It is argued that because the fungus is physically present but not obviously impacting the stands constitutes the major reason that a borate application must be aggressively pursued following the revised Regional Guidelines. Just as there is no point in thinning treatments that are not aggressive enough to reduce the bark beetle risk, there is no point in treatments if they lead to the establishment of Heterobasidion root rot pockets. Thus we recommend a Forest Health thinning and an associated application of an approved borate protectant.

Introduction

On September 23, 2010, district foresters Brian Bergman and John Gomez requested the assistance of Forest Health Protection to evaluate current stand conditions possibly at risk for insect and disease activity of Joey Project, Kernville Ranger District, Sequoia National Forest. NEPA documentation for Joey Project was completed in 1999 under CASPO (California Spotted Owl Sierra Province Interim Guidelines), thereby guidelines and regulations vary slightly from the current 2004 Sierra Nevada Framework. Work was contracted and initiated in 2000 but not completed; 537 acres remain untreated. The district is looking at renewing the environmental analysis and re-offering a potential timber sale.. This report covers present conditions, observations, and discussions during the field visit to several locations of the project.

Figure 1. *Representative stand of mixed conifer-Jeffrey pine type in Joey Project, Kernville Ranger District, showing that although tree mortality is not absent it is at endemic level.*

Joey Project is located on the western side of the Kern Plateau (Township 23 S, Range 34 E, Sections 19, 29-33; Township 23 S, Range 33 E, Sections 24,25, and 36). General geography is west-side of Kern Plateau, upper Salmon creek subwatershed, roughly from Horse Meadow south to Big Meadow. Elevation ranges between 7000 and 8200 feet. Much of the proposed units are Sierra Nevada east-side mixed conifer-pine forest types, with average tree diameters ranging from 15-21 inches, and canopy closures averaging around 50% (see Figure 1). Aspen and lodgepole pine are also found as dense homogeneous stands along wet drainages or meadows of Salmon Creek.

Figure 2. *Clumps of mid-size white fir creating dense stand conditions beneath large diameter Jeffrey pines.*

Observations and Current Conditions

446 acres of the total proposed 537 acres is mixed conifer-pine, site class 3. Natural stands are chiefly Jeffrey pine interspersed with white fir, sugar pine, and occasional California black oak. Topography and aspect delineate species composition on the landscape: sunny, exposed rocky slopes harbor pines with minor fir understory; variable-aged white fir predominate on northerly faces (see Figure 2). Average diameter ranges are in the moderate category, 15-21 inches DBH. Scattered legacy Jeffrey pines are seen throughout the project area, planned for leave. Ninety-two plantation acres of Jeffrey pine were initiated after a wildfire in 1960. A few variable-sized white firs and oaks manage to hold spaces within the dense canopies. Plantation diameters ranged from 6 to 18 inches (median 15 inch DBH).

Insects and disease activity in and around proposed project units appeared low, but stands have characteristics considered at moderate to high risk for potential bark beetle infestation. Basal areas in natural stands and plantations widely range from 30-600 ft^2/acre in Joey Project, but most of which are overstocked and considered above the threshold for potential attack by bark beetles in pines (> 120 ft^2/acre). According to Oliver (1995), the minimum SDI threshold for bark beetle caused tree mortality in pine forests in California is 230 SDI, while stands above 365 are at imminent risk for bark beetle epidemics. This is evidenced by recent native Jeffrey Pine Beetle (*Dendroctonus jeffreyi*) (JPB) activity detected in several scattered groups of large diameter trees within and surrounding the project area (see Figure 3). Group kills were estimated to have occurred in 2008 and 2009; no new 2010 attacks were found. Attacked trees were also found infested with pine engravers, woodborers, and red turpentine beetles.

Figure 3. *Group mortality of Jeffrey pines caused by Jeffrey pine beetle; 2007 estimated time of fade.*

White fir was clustered among pines in natural stands and densely overstocked. Tight groups of young fir trees counted as many as 50 stems within a 1/20 acre plot (see Figure 4). White fir composed a higher percentage of understory regeneration, but few trees greater than 25 inches were observed. Despite the fact that the fir dwarf mistletoes rarely produce brooms and the plants are so small some large mature firs in stands were categorized with Dwarf Mistletoe Ratings of 4-6 (Hawksworth, 1977). Whole tree mortality or top-kill is often categorized as fir engraver (*Scolytus ventralis*), but decline is frequently associated with root and stem pathogens, mistletoes, or previous injury causing physiological stress. General mortality rates for this area are fairly low and historical insect loss has been attributed to fir engraver removing understory small to mid-size white fir.

Figure 4. *Dense stocking of white fir in natural stands.*

Heterobasidion Root Disease

The inclusion of Figure 5 represents only the second time in the past 3 years that the authors have found a *Heterobasidion* conk in a pine stump, in westside forests of the southern Sierra Nevada (the other occasion was also in the Kernville RD). Observations of *Heterobasidion* conks in pine stumps have been extremely rare, while conks in fir stumps are ubiquitous. This does not mean that the *Heterobasidion* belongs to the "P" type, for it is possible for the "S" type to cause decay of a dead pine stump. But, it is not possible for the "S" type to cause disease of a living pine tree. Regardless of type, this conk demonstrates that the fungus exists in the project area. The authors examined many stumps and destructively sampled several, with the exception of the one photographed (Figure 5), no other evidence of *Heterobasidion* root disease was observed.

Figure 5. *Annosum root disease conk found in Jeffrey pine stump.*

The most significant disease problem within National Forests of the South Sierra Service area is Heterobasidion root rot in lower elevation forests. Most of these problems arose from past land managers not comprehending long term results of their actions. Today, failure to apply an approved borate protectant significantly increases risk for infection. For these reasons, proactive use of the borate is strongly recommended. The web site listed below provides links to the most important literature on this disease.

Heterobasidion Information http://www.fs.fed.us/r5/spf/fhp/heterobasidion.shtml

- R5 Insect & Disease Manual: *Heterobasidion* (pdf 1.9 MB)
- R5 *Heterobasidion* Handbook (pdf 98 KB)
- Cellu-Treat Information, Product Label, and Material Safety Data Sheets (pdf 356 KB)
- Otrosina Heterbasidion taxonomy paper (pdf 1.5 MB)
- CA Forest Pest Conditions 2009: *Heterobasidion* (pdf 2.4 MB)

- There is a white paper that should be considered prior to beginning a project-NEPA document. This white paper can be found at: http://www.fs.fed.us/r5/spf/fhp/pesticide/index.shtml It is referred to as the pesticide use advisory memorandum 06-01 (two documents on the web page, the cover letter and the attachment (which is the white paper). The attachment responds to Issues Raised by CATs Concerning Borax (Sporax) by David Bakke Regional Pesticide-Use Specialist.

- There is also a national risk assessment for "Borax" fungicides that discusses human as well as ecological health risks, located on-line at http://www.fs.fed.us/foresthealth/pesticide/risk.shtml

While David Bakke (Regional Pesticide-use specialist), Phil Cannon (Regional pathologist), and others have been working on updating Regional policy on Sporax, work is still ongoing. A current draft can be requested if necessary. As soon as updates are finished for review, it will be posted on the first web site listed above.

Dwarf Mistletoes

In providing an Integrated Pest Management strategy to promote overall improved forest health, dwarf mistletoes (*Arceuthobium* sp.) are included. First efforts should focus on basal area reduction to reduce bark beetle risk and promote tree vigor to increase overall stand resiliency (North *et al* 2010). In the selection for thinning, there is an opportunity to do some mistletoe mitigation while providing stress relief for residual trees. Shade tolerant firs encroaching on the drip line of legacy Jeffrey pines (see Figure 2), as well as those firs with heavy dwarf mistletoe infections should be selected against. Moisture stress from competing fir trees compounded with dwarf mistletoe infection, make pines more susceptible to Jeffery Pine beetle attack. As fir mistletoes also place stress on their hosts, drought conditions further increase risk for bark beetle attack for all trees.

Discussion of Management Options

Management suggestions are recommended to focus on pine retention, while retaining vertical and horizontal diversity to keep potential for bark beetle-associated mortality to a minimum. Treatment activities can meet regional ecological restoration objectives to maintain low rates of tree mortality from forest pests, as well reduce risk of catastrophic wildfire. No action alternatives assume higher of risk of tree loss, but still provide other ecological benefits.

No Action Alternative – Current stand conditions are at moderate risk to potential bark beetle infestation. According to 2006 Forest Health Monitoring Insect and Disease Risk model[1] which factors in existing vegetation data, it is estimated that 25-50% of tree basal area within project boundaries may be lost within the next 15 years unless stand conditions change. Similar to wildfires, significant loss of canopy cover and large diameter trees affect snow pack, water and soil retention. Conversion by loss of fire-tolerant species (pine) to fire-intolerant species (fir) would affect fire intensity and severity on the landscape. Zhang *et al*. (2007) found that high density white fir stands were estimated to accumulate over 50 Mg/hectare of dry stem wood of flammable material, compared to treated stands which significantly reduced fuel loads.

Bark beetle outbreaks originate in high risk sites, most often triggered by drought periods that weaken resistance and decrease trees' abilities to fend off attacks. During years of average rainfall, Jeffrey Pine Beetle caused mortality is typically low as populations are regulated by natural enemies, climate, and availability of susceptible hosts (Smith et al. 2009). High levels of bark beetle-caused mortality have been correlated with periodic drought events in California (Smith, 2007). Recent drought conditions had most likely incited Jeffrey pine beetle activity in many areas of Lake Tahoe Basin Management Unit and Inyo National Forest where hundreds of large diameter trees (> 30 inches) were killed. Drought cycles over the past two decades have caused considerable white fir mortality in this area. According to 2010 Forest Health Monitoring Aerial Survey[2], white fir mortality associated with fir engraver doubled since 2009; over 3000 acres in detected directly east in the Dome Land Wilderness, Sequoia National Forest. In addition, some units of the previous Kangaroo project were affected by the McNally wildfire in 2002. Trees weakened from previous injury, prior infection, or under severe stress are predisposed to bark beetle attack, particularly fir engraver. A large percentage of Jeffrey pine beetle-associated mortality in Sequoia National Forest in 2009 was detected across 1000 acres within the fire perimeter; 75% had moderate to severe bole char while 25% had no damage (2009 California Forest Pest Conditions).

---

[1] More information about USDA Forest Service, Forest Health Monitoring Insect and Disease Risk Map can be found at: http://www.fs.fed.us/r5/spf/fhp/fhm/risk/index.shtml

[2] USDA Forest Service, Forest Health Monitoring Aerial Detection Surveys 2010. More information can be found at: http://www.fs.fed.us/r5/spf/fhp/fhm/aerial/index.shtml

Dead trees also provide benefits to other components of the ecosystem. Several bird species such as the California Spotted Owl greatly depend on large snags for foraging and nesting. Snags and fallen logs contribute to providing habitat for other species of mammals and insects which in turn compose the prey base for higher orders. For a short term, bark beetles are a prime food source for woodpeckers and small mammals. Decomposing logs return nutrients and substrates to the forest floor that are consumed by developing trees or lost during high intensity wildfires.

Silvicultural Alternative – Thinning has been proven as the most effective management tool in preventing or mitigating effects from bark beetles and other damage agents (Fettig et al. 2007). Pines experience growth release after thinning operations improving individual tree resistance and resilience, even during periods of high beetle populations. Suggested prevention treatments such as maintaining stocking levels below normal (60% or less) reduce resource competition and susceptibility of insect attack. Thinning above recommended limits in natural stands may result in unacceptable loss, but projected mortality would still be lower than if left untreated. Older plantations are most often highest risk for infestation due to higher proportions of host type and preferable size classes compared to natural stands. Strategies should plan for thinning targets of least 20-year intervals for next re-entry. As mentioned previously, treatments are not intended to eliminate all bark beetle-associated mortality, but rather reduce risk for epidemic levels of loss.

Targeted/High value Selection – For Jeffrey pines, long-term prevention strategies are strongly encouraged over short-term suppression measures. However, infested tree removal and insecticides can be effective over small areas or on individual high-value trees, but are not recommended for large-scale treatments. In campgrounds or administrative areas, prompt removal of currently infested trees can reduce attack potential on residual live trees, mitigating further loss. Proper treatment of infested wood is necessary for to insure broods are destroyed; slash should also be properly disposed to prevent *Ips* infestations. Insecticide sprays are highly successful at preventing initial beetle attack, but need annual reapplication for continued protection. Cost, timing, application procedures, and feasibility can be further discussed with FHP personnel.

Forest Health Protection supports proactive management that seek to retain stand integrity while improving overall stand resiliency and resistance against potential insect/disease infestation or other disturbance agents. Proposed management activities will also benefit other project objectives such as fuel reduction/wildfire prevention. The strategies outlined by the district for forest health improvement are concurrent with FHP prevention objectives and desired outcomes. While Joey project area is relatively free of Heterobasidion root disease, it is incumbent to bequest the next generation of land managers a similar (or improved) condition of the site. Following Regional Office guidelines for mitigating the impact of this disease will help reach those goals. If you have any concerns or require further information regarding this report, please do not hesitate to contact us.

/s/
Beverly Bulaon
Entomologist
Forest Health Protection
(209) 532-3671 x323
bbulaon@fs.fed.us

/s/
Martin MacKenzie
Plant Pathologist
Forest Health Protection
(209) 532-3671 x242
mmackenzie@fs.fed.us

cc: Julie Lydick
Sheri Smith
Phil Cannon
Dave Bakke
Brian Bergman
Pat Dauwalder
John Gomez

References cited

2009 California Forest Pest Conditions. Published by California Forest Pest Council; Davis, CA.

Fettig, C., K. Klepzig, R.F. Billings, A.S. Munson, T.E. Nebeker, J.F. Negron, and J. T. Nowak 2007. The effectiveness of vegetation management practices for prevention and control of bark beetle infestations in coniferous forest of the western and southern United States, Forest Ecology and Management, 238: 24-53.

Hawksworth, F. G. 1977. The 6 class Dwarf Mistletoe Rating system. USDA For Ser. GTR RM -48 7 pp

Oliver, W. W. 1995. Is Self-thinning in Ponderosa Pine ruled by Dendroctonus Bark Beetles? *In* Proceedings of 1995 National Silvicultural Workshop, GTR-RM-267, USDA Forest Service, Forest Service, Rocky Mountain Research Station, Fort Collins, CO. Pgs 213-218.

Smith, S. 2007. Bark beetles and vegetation management in California. USDA Forest Service, Pacific Southwest Region, Forest Health Protection. May 2007.
http://www.fs.fed.us/r5/spf/fhp/wbbi/CABarkBeetlesVegMgt_2007.pdf

Smith, S., R. R. Borys, and P. Shea 2009. Jeffrey Pine Beetle. USDA Forest Service, Forest Insect and Disease Leaflet, No. 11. 8 pgs.

Zhang, J., W.W. Oliver, and M.W. Ritchie 2007. Effect of stand densities on stand dynamics in white fir forests in northeast California, USA. Forest Ecology and Management, 244: 50-59.